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(54) Title: ANTIMICROBIAL COMPOSITIONS, PRODUCTS AND METHODS EMPLOYING SAME

(57) Abstract: Antimicrobial compositions that provide enhanced immediate and residual anti-viral and antibacterial efficacy against rhinovirus, rotavirus, Gram-positive bacteria, Gram-negative bacteria and combinations thereof. More specifically, antimicrobial compositions comprising an organic acid or organic acid mixture and a short-chain anionic surfactant having at least one of a large head group; a branched alkyl chain and an unsaturated alkyl chain. Further, products incorporating the antimicrobial compositions of the present invention and methods of using the antimicrobial compositions and products disclosed herein.

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ANTIMICROBIAL COMPOSITIONS, PRODUCTS AND METHODS EMPLOYING SAME

FIELD OF THE INVENTION

The present invention relates to antimicrobial compositions, products incorporating said antimicrobial compositions and methods of using the present antimicrobial compositions and products. More specifically, the present invention relates to antimicrobial compositions comprising an organic acid or organic acid mixture, a specific, short-chain anionic surfactant having at least one of the following: a large, hydrophilic head group; an unsaturated structure; and/or a branched structure.

BACKGROUND OF THE INVENTION

Human and mammalian health is certainly impacted by the spread of microbial entities at home, school, work and in the environment generally. Indeed, viruses and bacteria continue to cause a variety of sicknesses and ailments, prompting high absenteeism in schools and places of employment. In the wake of widespread food poisoning and the like, the public has become even further concerned with sanitization, both of person and property. Consequently, those of skill in the art have focused their research endeavors on the identification and deployment of suitable antimicrobial compositions, and specifically those that provide immediate and residual kill of microbes, with or without the use of water.

A comprehension of the vast benefits achieved via practice of the present invention requires an understanding of the various microbes against which the present compositions are effective. Bacteria found on human skin may be divided into two groups, namely, resident and transient bacteria. Resident bacteria are Gram-positive bacteria that establish as permanent microcolonies on the surface and outermost layers of the skin. Such bacteria play a fundamental role in preventing the colonization of other, more harmful bacteria and fungi. Transient bacteria are bacteria that are not part of the normal resident of the flora of the skin. Rather, transient bacteria are deposited when airborne contaminated material lands on the skin or when contaminated material is brought into physical contact with such bacteria. Transient bacteria are typically divided into two subgroups: Gram-positive and Gram-negative. Gram-positive bacteria include pathogens such as *Staphylococcus aureus*, *Streptococcus pyogenes* and *Clostridium botulinum*. Gram-negative bacteria include pathogens such as *Salmonella*, *Escherichia coli*,

Klebsiella, *Haemophilus*, *Pseudomonas aeuginosa*, *Proteus* and *Shigella dysenteriae*. Gram-negative bacteria are generally distinguished from Gram-positive bacteria via the existence of an additional protective cell membrane in the former, which often results in Gram-negative bacteria being less susceptible to conventional, topical antibacterial actives.

There exist several contemporary compositions and methods for reducing and/or eliminating the formation of bacteria and/or viruses. For example, it is well known that the washing of hard surfaces, food (*e.g.* fruit or vegetables) and skin, especially the hands, with antimicrobial or non-medicated soap, is effective against viruses and bacteria. Actually, removal of the viruses and bacteria is due to the surfactancy of the soap and the mechanical action of the wash procedure, rather than the function of an antimicrobial agent. Thus, it is recommended that people wash frequently to reduce the spread of viruses and bacteria. However, many conventional products and methods of sanitization, including washing, fail to address the dilemma of sanitization "on the go", that is to say, when a consumer is removed from the benefit of running water. Those skilled in the art have attempted to resolve this dilemma via the incorporation of antimicrobial agents into disinfecting lotions, cleansing wipes and the like. Such articles reduce the need for water during or following the application of the subject composition.

Other conventional antimicrobial cleansing products include deodorant soaps, hard surface cleaners, and surgical disinfectants. These traditional, rinse-off antimicrobial products have been formulated to provide bacteria removal during washing. A few such products, including antimicrobial soaps, have also been shown to provide a residual effectiveness against Gram-positive bacteria, but provide limited residual effectiveness against Gram-negative bacteria. By "residual effectiveness", it is meant that the subject antimicrobial controls microbial growth on a substrate by either preventing growth of microbes or engaging in continuous kill of microbes for some period of time following the washing and/or rinsing process. To address the dilemma of limited residual efficacy against Gram-negative bacteria, those skilled in the art have sought to incorporate high levels of alcohol and/or harsh surfactants into contemporary antimicrobial products, which have been shown to cause dryness and irritation to skin tissues.

Thus, there remains a substantial need to identify and deploy antimicrobial compositions that may be used by consumers "on the go"; provide immediate and residual kill of microbes with or without washing; and prevent dryness and irritation to skin following application. Despite providing a quasi solution to the dilemma of water availability, those skilled in the art have yet to identify antimicrobial compositions that address the problems associated with dryness and irritation to skin. In fact, attempts to resolve this dilemma have generally resulted in the adoption

of aqueous-based antimicrobial formulas incorporating high levels of zwitterionic surfactants that are too weak to provide significant immediate or residual benefits. Others have attempted to address the dilemma of dryness or irritation to skin by incorporating cationic surfactants into antimicrobial compositions, which have been associated with adverse impacts on the environment and human health. Yet others still have attempted to resolve this dilemma via the incorporation of long-chain anionic surfactants into antimicrobial compositions, which are intended to prevent skin tissue penetration. Nevertheless, such surfactants are often associated with poor phase stability in product, incompatibility with commercial antimicrobial agents, and low residual kill performance. Indeed, the identification of a balance between the factors of antimicrobial performance, skin mildness and water availability continues to be a key concern to those of skill in the antimicrobial art.

SUMMARY OF THE INVENTION

The present invention addresses and resolves all of the problems associated with the employment of conventional antimicrobial compositions and/or products. Indeed, it has been surprisingly discovered that a composition incorporating an organic acid or organic acid mixture, a specific short-chain anionic surfactant having at least one of a large, hydrophilic head group; an unsaturated structure; and/or a branched structure; constitutes a viable advancement and alternative in the realm of antimicrobial formulations. The antimicrobial compositions of the present invention are adapted for direct application to human skin, without causing dryness or irritation. Moreover, the antimicrobial compositions of the present invention are designed for use with or without water, and provide immediate and residual effectiveness in either instance against a variety of viruses and bacteria, including rotavirus, rhinovirus, respiratory syricytial virus (RSV), coronavirus, Gram-positive and Gram-negative bacteria.

The specific, anionic surfactant of the present invention presents a particularly novel aspect of the present compositions. Those of skill in the art have generally relied upon the incorporation of longer chain (*i.e.* C_{12} to C_{16}) anionic surfactants into antimicrobial compositions. Conventional surfactants, comparable to the acyl components found in the phospholipid matrix of the cell membrane of bacteria and virus, are thought to possess optimum antimicrobial activity with reduced skin tissue penetration. However, conventional anionic surfactants have been associated with low solubility under acidic conditions, poor compatibility with cationic antimicrobial agents, slow dissolution kinetics and limited residual antimicrobial performance.

Against the conventional wisdom in the art, the short chain anionic surfactants of the present invention comprise at least one of the following characteristics: a large, hydrophilic head group; an unsaturated structure; and/or a branched structure. Indeed, the surfactants of the present invention have traditionally been regarded as unsuitable for incorporation into an antimicrobial composition, based on the belief that such surfactants possess relatively low surface activity. Contrary to the traditional wisdom, it has been surprisingly discovered that the surfactants of the present invention deliver enhanced antimicrobial efficacy against rotavirus, rhinovirus, respiratory syricytial virus (RSV), coronavirus, Gram-negative bacteria and Gram-positive bacteria. More importantly, the large head group, unsaturated structure and/or branched structure of the present surfactants reduces or limits their tendency to penetrate skin tissue, while maximizing the immediate and residual effectiveness of the antimicrobial compositions in which they are incorporated. Further, the anionic surfactants of the present invention exhibit stability in an aqueous product at a low pH, are compatible with cationic antimicrobial agents and convey strong residual antimicrobial activity when the substrate on which they are applied is later inoculated with virus or bacteria.

Thus, in accordance with a first aspect of the present invention, antimicrobial compositions, comprising an organic acid or organic acid mixture, a specific, short-chain anionic surfactant mixture are disclosed. Against the conventional wisdom in the art, suitable anionic surfactants for use in the context of the present invention comprise a chain length of from about C_4 to C_{12} and at least one of the following characteristics: a large, hydrophilic head group; an unsaturated structure; and/or a branched structure. In yet another aspect of the present invention, the antimicrobial compositions disclosed herein optionally further comprise a calcium ion scavenger and/or an anti-foam agent. The compositions of the present invention are adapted to provide immediate and residual kill of numerous bacteria and viruses, with or without the use of water and without causing dryness or irritation to skin.

In accordance with a second aspect of the present invention, products incorporating the antimicrobial compositions of the present invention are disclosed. Such products may take an assortment of shapes and forms depending on the precise application for which deployment of the product is desired and the needs and/or abilities of the formulator. In any instance, the products of the present invention are effective in eradicating numerous bacteria and viruses, both immediately and residually and are adapted to prevent dryness and/or irritation to mammalian skin tissue.

In accordance with a third aspect of the present invention, methods of using the antimicrobial compositions and products of the present invention are disclosed. The methods of the present invention are adapted to achieve immediate and/or residual kill of a variety of viruses and bacteria, without irritating the skin and with or without the use of water.

These and other objects, features, and advantages will become apparent to those of ordinary skill in the art from a reading of the following detailed description and the appended claims. All percentages, ratios and proportions herein are by weight, unless otherwise specified. All temperatures are in degrees Celsius (^{o} C) unless otherwise specified. All documents cited are in relevant part, incorporated herein by reference.

DETAILED DESCRIPTION OF THE INVENTION

Antimicrobial Compositions

In accordance with a first aspect of the present invention, antimicrobial compositions, adapted for immediate and residual efficacy against a variety of bacteria and viruses, are provided. The compositions of the present invention comprise an organic acid or organic acid mixture; an anionic surfactant having a chain length of from about C_4 to about C_{12} and at least one of the following characteristics: an unsaturated structure, a branched structure; and/or a hydrophilic head group having a total head group size (defined, *infra*) of between about 4 to about 15 Angstroms. In another aspect of the present invention, the antimicrobial compositions disclosed herein optionally further comprise a calcium ion scavenger and/or anti-foam agent. The compositions of the present invention are characterized by a pH of between about 2.0 to about 4.5, depending on the specific constituents of the present antimicrobial compositions and the application for which their use is intended.

Organic Acid

Indeed, in one aspect of the present invention, the antimicrobial compositions disclosed herein comprise an amount of an organic acid or organic acid mixture. Organic acids, for purposes of the present disclosure, are defined as proton-donating agents that remain at least partially undissassociated in a concentrated composition and remain so when the compositions are diluted during washing and rinsing. Without wishing to be bound by theory, the organic acids of the present invention serve to protonate the carboxylate functionalities on the phospholipid

membrane of bacteria and virus and reduce the tendency of the membrane to electronically repel anionic surfactants, thereby facilitating proper interaction between the present, anionic surfactants and the membrane. Moreover, the organic acids disclosed herein facilitate the creation of a low pH buffer on the surface of a substrate, thereby prolonging the residual antimicrobial activity of the compositions and products in which they are incorporated.

Preferably, the present organic acids are added directly to the compositions of the present invention in acidic form or are formed by adding the conjugate base of the desired acid and an amount of a separate acid sufficient to form the undissociated acid from the base. The antimicrobial compositions of the present invention comprise from about 0.2% to about 70%, preferably about 0.5% to about 40%, more preferably from about 1.0% to about 30%, based on the total weight of the antimicrobial composition, of an organic acid or organic acid mixture.

Suitable organic acids of the present invention include, but certainly are not limited to: pyroglutamic acid, adipic acid, gluconic acid, glyconolactone acid, glutamic acid, glycolic acid, glutaric acid, tartaric acid, ascorbic acid, benzoic acid, salicylic acid, citric acid, malic acid, succinic acid, lactic acid, carboxymethylcellulose and mixtures thereof. In another aspect of the present invention, suitable organic acids for incorporation into the present compositions are characterized by a pKa of greater than about 3.0. Without wishing to be bound by theory, the pKa selection limitation of the present organic acids serves the fundamental goal of ensuring that at least 50% of the organic acids incorporated into the present compositions remain undissociated at the desired pH of from about 2.0 to about 4.5 (discussed, *infra*).

Optional Calcium Ion Scavenger

In another aspect of the present invention, the compositions disclosed herein comprise a calcium ion scavenger. Without wishing to be bound by theory, the calcium ion scavengers of the present invention, too, facilitate the disruption of the cell membrane of bacteria and viruses by the present, anionic surfactants via capture of the calcium ions of the phospholipid cell membrane. Without wishing to be bound by theory, said calcium ions are believed to exist within and around the cell membrane, thereby often preventing the penetration of conventional surfactants. The present, calcium ion scavengers are a particularly preferred ingredient of the present antimicrobial compositions when the targeted microbial is rotavirus. Suitable calcium ion scavengers of the present invention, include, but are not limited to: citric acid, malic acid, succinic acid, polyacrylic acid, copolymers of acrylic acid and maleic acid, oxydisuccinic acid, nitrilotriacetic acid, iminodisuccinic acid, tartrate disuccinic acid, tartrate monosuccinic acid,

ethylenediaminetetraacetic acid, pyrophosphoric acid and mixtures thereof. In yet another aspect of the present invention, the calcium ion scavengers of the present invention are characterized by a pKa of lower than about 3.0. Moreover, in another aspect of the present invention, suitable calcium ion scavengers are characterized by a calcium ion binding constant (log P) of greater than about 3.0 at a pH of about 3.

Anionic Surfactant

The anionic surfactants of the present invention constitute a particularly novel and unobvious aspect of the present invention. Indeed, it has been surprisingly discovered that, contrary to the conventional wisdom in the art, anionic surfactants having a chain length of from about C_4 to about C_{12} and at least one characteristic selected from: a large hydrophilic head group; an unsaturated structure; and/or a branched structure; provide enhanced performance benefits, while minimizing dryness and/or irritation to mammalian skin tissue. The short chain anionic surfactants of the present invention exhibit phase stability in formulation, compatibility with other antimicrobial agents and residual efficacy of the antimicrobial compositions in which they are incorporated. Without wishing to be bound by theory, it is believed that the interaction of short chain anionic surfactant with the phospholipid cell membrane of bacteria and virus, facilitated by the protonation of carboxylate funtionalities at the surface of the membrane, disrupts the membrane and denatures cellular proteins, thereby providing rapid microbiocidal activity.

The antimicrobial compositions of the present invention comprise from about 0.1% to about 40%, preferably from about 0.2% to about 30%, more preferably from about 0.3% to about 20% of an anionic surfactant mixture. In another aspect of the present invention, the short-chain anionic surfactants disclosed herein are incorporated into the present, antimicrobial compositions at a level of greater than about 25%. In another aspect of the present invention, the anionic surfactants useful for incorporation into the present antimicrobial compositions comprise a relatively short carbon chain, preferably between about C_4 to about C_{12}, more preferably between about C_6 to about C_{11}, most preferably between about C_6 to about C_{10}. It should be noted, however, that, due to the fact that some surfactants suitable for incorporation into the present antimicrobial compositions are commercially available in mixed chain lengths, the average chain length of the resultant anionic surfactant mixture may differ from the above-described ranges.

To reiterate, those of skill in the art have generally avoided the incorporation of so-called "short-chain" anionic surfactants into antimicrobial compositions. This trend is believed to be due in part to the conventional wisdom in the art that short-chain anionic surfactants are

characterized by decreased interfacial activity and decreased interaction with the phospholipid membrane of bacteria and virus, and thus, provide poor microbiocidal activity. Accordingly, those of skill in the art have generally relied upon the employment of anionic surfactants with chain lengths of from C_{12} to C_{16} in antimicrobial compositions. The chain lengths of such surfactants are comparable to those of the acyl components in the phospholipid membrane of bacteria and virus, and thus, are thought to provide optimum microbiocidal activity. Moreover, longer chain surfactants have conventionally been thought to be less capable of skin penetration, and thus, less likely to cause dryness and irritation to skin. Nevertheless, conventional, longer chain anionic surfactants often exhibit poor phase stability in an acidic product matrix, incompatibility with cationic antimicrobial agents and decreased residual antimicrobial activity. Conversely, the shorter chain anionic surfactants of the present invention exhibit surprisingly high immediate microbiocidal activity, phase stability in broad concentration ranges of acidic aqueous matrices and compatibility with cationic antimicrobial agents. Importantly, the anionic surfactants of the present invention prevent dryness or irritation to skin and demonstrate strong residual microcidial activity on a target substrate when the substrate is later inoculated with bacteria or virus.

In another aspect of the present invention, the short chain anionic surfactants disclosed herein possess an unsaturated structure and/or a branched, hydrophobic group with a total carbon content ranging from about C_4 to about C_{12}, preferably from about C_6 to about C_{11} and more preferably from about C_6 to C_{10}. In yet another aspect of the present invention, the short-chain anionic surfactants disclosed herein comprise a hydrophilic head group with a total head group size of less than about 15 Angstroms, preferably less than about 10 Angstroms, more preferably between about 4 to about 7 Angstroms. By "total head group size," it is meant the accumulated size of every substituent on the hydrophilic head group of the present anionic surfactants. That is to say, the present anionic surfactants may comprise more than one substituent on their subject hydrophilic head groups, for a combined, total hydrophilic head group size falling within the above-listed, ranges. Without wishing to be bound by theory, it is believed that the unsaturated structure and/or branched structure and/or large hydrophilic head group of the present, anionic surfactants increases their water solubility, increases their compatibility with cationic agents, increases steric hindrance to their disruption of the stratum conium layer of skin and maintains their substantivity to the phospholipid membrane of bacteria and viruses.

The "hydrophilic head group" is defined as the hydrophilic portion (which may contain both non-hydrocarbon and hydrocarbon units) of the anionic surfactant, measured from the first

polar atom to the end of the hydrophilic segment that links to the hydrophobic body. For example, the hydrophilic head group of alkyl glyceryl sulfonate R-O-$CH_2CH(OH)CH_2$-SO_3Na is -O-$CH_2CH(OH)CH_2$-SO_3Na. The hydrophilic head group size is estimated from the Van der Waals radius of the atoms and the configuration of the surfactant molecule. Suitable hydrophilic head groups of the present invention with a size of less than about 10 Angstroms include, but are not limited to: glyceryl ether sulfonates and, for compositions having a pH of greater than 3.5, isethionates, sulfosuccinates, amidosulfonates and ethoxylated sulfonates. .

In yet another aspect of the present invention, the head group of the anionic surfactant is characterized by substitution of one or more substituents. By "substituents" it is meant any hydrophilic segment that is bonded to the head group, defined hereinbefore, of the present anionic surfactants. Without wishing to be bound by theory, it is believed that such increased substitution on the head group of the present anionic surfactants further increases the size and hydrophilicity of the head group. Suitable hydrophilic head groups of the present invention with multiple substituents include, but are not limited to, alpha sulfo fatty acid, and if the pH of the present antimicrobial compositions is greater than 3.5, monoester of sulfosuccinic acid. To reiterate, the head group size of the present anionic surfactants is defined on the basis of Angstroms, as discussed *supra*. Thus, although the hydrophilic head group of the present anionic surfactants may comprise more than one substituent, the total hydrophilic head group size should not exceed the preferred size ranges, set forth hereinbefore, in Angstroms.

Accordingly, suitable anionic surfactants of the present invention, meeting all of the criteria discussed hereinbefore include, but certainly are not limited to: linear or branched alkyl glyceryl sulfonate, alkyl alpha sulfo fatty acid, alpha olefin sulfonate, branched alkyl sulfonate, branched alkyl benzene sulfonate, branched alkyl phosphonate and if the pH of the antimicrobial composition is greater than about 3.5, secondary alkyl sulfate, alkyl isethionate, monoester of alkyl sulfosuccinic acid, alkyl aminosulfonate, alkyl ethoxylated sulfonate, and combinations thereof. The aforementioned list is only intended to serve as a guide to the formulator of the present, antimicrobial compositions. Additional anionic surfactants having a chain length of from about C_4 to about C_{12} and comprising at least one of the following characteristics are suitable for use herein: an unsaturated structure; a branched structure and/or a hydrophilic head group size as described hereinbefore. Selection of the appropriate anionic surfactant for use in the antimicrobial compositions of the present invention will depend upon the needs and/or abilities of the formulator. In another aspect of the present invention, other surfactants, many commercially available, are incorporated into the antimicrobial compositions of the present invention. Said

surfactants, although depending on the precise form of the desired antimicrobial composition, include, but certainly are not limited to: paraffin sulfonate, hydrolyzed methyl ester sulfonate, alkyl sulfosuccinate, alkyl glyceryl sulfonate, alpha olefin sulfonate, alkyl isethionate, secondary alkyl sulfate, branched alkyl benzene sulfonate, alkyl sulfate and combinations thereof.

It should be noted and underscored that selection of the appropriate anionic surfactant for use in the context of the antimicrobial compositions of the present invention will depend upon several factors, including, but certainly not limited to: the nature of the substrate for which use of the antimicrobial compositions disclosed herein is desired and the needs and/or abilities of the formulator and/or practitioner of the present compositions. For instances in which the mildness of the present antimicrobial compositions on skin is not an issue, short chain anionic surfactants having a hydrophilic head group size of less than about than 4 Angstroms and/or a linear structure may be suitable for use in the context of the present invention. Indeed, for instances in which mildness of the present compositions on skin is not a fundamental concern, suitable anionic surfactants for use in the context of the present invention include, but certainly are not limited to: sulfonates and sulfates having a linear chain with a chain length of from about C_4 to about C_{12}, preferably having a chain length of from about C_6 to about C_{12}, more preferably having a chain length of from about C_8 to about C_{12}.

Anti-Foam Agent

In another aspect of the present invention, the antimicrobial compositions disclosed herein comprise an anti-foam or suds suppression agent. Incorporation of said agents is particularly desired for applications in which the present antimicrobial compositions comprise high sudsing, short chain anionic surfactants such as alkyl glyceryl sulfonate and/or a level of anionic surfactant of greater than about 1 weight percent. Incorporation of an anti-foam agent or suds suppression system is further advantageous in compositions for which low foaming is desired, particularly when such foaming has the affect of decreasing the conveyance of antimicrobial dosage. In one aspect of the present invention, the antimicrobial compositions disclosed herein comprise an anti-foam or suds suppression agent, present at a level of from about 0.0001% to about 15%, preferably from about 0.001% to about 10%, most preferably from about 0.005% to about 5% by weight of the antimicrobial composition. In another aspect of the present invention, the anti-foam agent is present in an amount of at least 1 ppm by weight of the total composition. Without wishing to be bound by theory, it is believed that incorporation of an anti-foam agent or suds suppression system serves the fundamental goal of controlling the suds profile

of the present compositions during production and ensuring the delivery of an optimum dosage of the present antimicrobials during employment. Indeed, suitable suds suppressing systems for use herein may comprise essentially any known antifoam compound that exhibits stability at a pH of about 2.0 to about 4.5, including, but not limited to, those selected from the group consisting of: silicone antifoam compounds, silicone emulsions, 2-alkyl and alkanol antifoam compounds, mineral oil emulsions, hydrocarbon oil emulsions, polyalkylene emulsions and combinations thereof.

Silicone suds suppressor technologies and other anti-foam agents useful herein are extensively documented in "Defoaming, Theory and Industrial Applications", Ed., P.R. Garrett, Marcel Dekker, N.Y., 1973, ISBN 0-8247-8770-6, incorporated herein by reference. See especially the chapter "Surfactant Antifoams" (Blease et al). See also U.S. Patents 3,933,672 and 4,136,045, both incorporated herein by reference. Highly preferred silicone suds suppressors are the compounded types known for use in antimicrobial compositions, including, for example, polydimethylsiloxanes having trimethylsilyl or alternate endblocking units. Such compounds may be compounded with silica and/or with surface-active nonsilicon components, as illustrated by a suds suppressor comprising 12% silicone/silica, 18% stearyl alcohol and 70% starch. A suitable, commercial source of the silicone active compounds is Dow Corning Corp.

Optional Nonionic Agent

In accordance with another aspect of the present invention, the antimicrobial compositions disclosed herein further comprise a nonionic agent. In one aspect of the present invention, suitable nonionic agents for use in the present compositions are selected from the group consisting of: alkyl polyols, alkyl alcohols, phenols, chloro phenols, polyphenols and mixtures thereof. Without wishing to be bound by theory, it is believed that the optional nonionic agent of the present invention serves many roles, including, but certainly not limited to, increasing the antibacterial efficacy, in both immediate and residual kill, of the organic acid and short chain anionic surfactant system of the present invention. Some alkyl polyols, such as 1-(2-ethylhexyl)glycerol ether, have conventionally been thought to inhibit bacteria, and thus, have traditionally been employed as preservatives in commercial cosmetic products. Indeed, it has surprisingly been discovered that use of alkyl polyols and alkyl alcohols in the present compositions has the affect of increasing the immediate and residual activity of the present compositions. When present, the nonionic agents of the present invention are incorporated into the present antimicrobial compositions in an amount of from about 0.1% to about 10%, preferably from about 0.1% to about 5%, more preferably from about 0.1% to about 3%, by weight of the

total, antimicrobial composition. In another aspect of the present invention, when the antimicrobial compositions of the present invention comprise a nonionic agent, said agent comprises a carbon chain length of from about C_3 to about C_{12}. Suitable nonionic agents for incorporation into the antimicrobial compositions of the present invention include, but certainly are not limited to: 1-(2-ethylhexyl) glycerol ether, octyl glycerol ether, 2-(2-ethylhexylxoxy) propanol, octyloxy propanol, 1-(2-ethylhexyloxy) ethanol, octyloxy ethanol, 1,2 hexylenediol, 1,2-cyclohexanedimethanol, isopropyl glycerol ether, 4-chloro-3-xylenol and combinations thereof. In another aspect of the present invention, the nonionic agent is branched, unsaturated or linear. In yet another aspect of the present invention, the nonionic agent is substituted with compounds selected from the group consisting of: alcohols, polyols, phenols, chloro phenols, polyphenols and combinations thereof.

Optional Adjunct Ingredients

In another aspect of the present invention, the compositions disclosed herein will comprise one or more adjunct ingredients. Said ingredients may be employed to increase the mildness of the desired composition, increase immediate and/or residual efficacy of the subject compositions, improve the wetting characteristics of the subject compositions upon application to a target substrate, operate as solvents for diluted compositions, and/or serve to modify the aesthetic characteristics of the composition. In one aspect of the present invention, the compositions disclosed herein comprise from about 0% to about 70%, preferably from about 0% to about 62%, more preferably from about 0% to about 10%, of an alcohol solvent. Suitable alcohol solvents of the present invention include, but are not limited to, ethanol, propanol, butanol, probpylene glycol, diethylene glycol, dipropylene glycol and mixtures thereof.

In another aspect of the present invention, the compositions disclosed herein comprise from about 0% to about 10%, preferably from about 0% to about 5%, more preferably from about 0% to about 1%, of a cationic antimicrobial agent. Depending on the region in which the formulator chooses to practice the present compositions, the inclusion of one or more cationic surfactants may be necessary for the procurement of regulatory approval. Suitable cationic antimicrobial agents for use in the compositions of the present invention, include, but certainly are not limited to, benzalkonium chloride, benzethonium chloride, triclocarban, tricolsan, chlorhexidine and mixtures thereof.

In yet another aspect of the present invention, the compositions disclosed herein comprise from about 0% to about 5%, preferably from about 0% to about 2%, of a heavy metal salt selected from the group consisting of: silver, zinc, copper and mixtures thereof. Incorporation of said

heavy metal salt serves to increase the antimicrobial activity and the viscosity of the present, antimicrobial compositions. Moreover, the other ingredients of the present compositions have exhibited compatibility with the heavy metal salts disclosed herein. In another aspect of the present invention, the compositions disclosed herein comprise from about 0% to about 20%, preferably from about 0% to about 5%, of a skin emollient or moisturizer. Such ingredients serve the fundamental purpose of increasing the mildness (discussed *infra*) of the present antimicrobial compositions and are particularly desired when incorporating the present antimicrobial compositions into a skin care product (discussed*infra*).

In yet another aspect of the present invention, one or more adjunct ingredients are incorporated into the antimicrobial compositions disclosed herein, to facilitate formulation of the desired composition. Those of skill in the art will readily appreciate that the inclusion of additional adjunct ingredients is often necessary to formulate certain ingredients included in the present compositions and in antimicrobial compositions generally. Indeed, it has been discovered, and documented via the present disclosure, that the formulation of certain perfumes and/or skin emollients in antimicrobial compositions requires the use of alkyl polyether-type emulsifiers. It has been learned that the use of said alkyl polyether-type emulsifiers is necessary to achieve physical stability of the resultant antimicrobial product when attempting to formulate certain perfumes and/or skin emollients. Although other types of emulsifiers are commercially available and often used in the context of formulation of antimicrobial-type compositions, the inventors of the subject matter disclosed herein have discovered that the use of emulsifiers other than those of the alkyl polyether-type, results in a chemically instable, yet efficacious, end product

Thus, in yet another aspect of the present invention, the antimicrobial compositions disclosed herein comprise from about 0.05% to about 5%, preferably from about 0.1% to about 1%, more preferably from about 0.2% to about 0.5% of an alkyl polyether-type emulsifier. Non-limiting examples of alkyl polyether-type emulsifiers suitable for incorporation into the antimicrobial compositions disclosed herein include: isoceteth-20 (CAS No. 69364-63-2) and ceteth -20 (CAS No. 9004-95-9),. In yet still another aspect of the present invention, use of the alkyl polyether-type emulsifiers disclosed herein are provided for use in the context of formulation of any antimicrobial composition comprising one or more otherwise physically instable adjunct ingredients, and not specifically limited to the antimicrobial compositions disclosed herein. In this respect, examples of said otherwise physically instable adjunct ingredients, include, but certainly are not limited to: perfumes, skin emollients, other nonionic agents and mixtures thereof.

In yet still another aspect of the present invention, other ingredients are included into the antimicrobial compositions to achieve physical stability for perfumes, skin emollients and other adjunct incorporated therein that otherwise exhibit physical instability absent the use of such adjuncts. Accordingly, the present invention further seeks to encompass the use of sulfonate anionic surfactant having a chain length of C_{12} to C_{18} are suitable for use in the context of the antimicrobial compositions disclosed herein, and are particularly preferred when the formulator of the present compositions seeks to incorporate certain adjuncts such as perfumes, skin emollients and combinations thereof. Thus, in accordance with this aspect of the present invention, the antimicrobial compositions disclosed herein comprise from about 0 to about 5%, preferably from about 0.1% to about 2%, more preferably from about 0.2% to about 1%. Suitable sulfonate anionic surfactants for use in the context of the present invention include, but certainly are not limited to: C_{14-18} paraffin sulfonate and C_{14-18} alkyl alpha olefin sulfonate. . To reiterate, the incorporation of sulfonate anionic surfactants is particularly preferred in the context of the present invention when the formulator of the present compositions seeks to include perfumes, skin emollients and combinations thereof.

pH of Antimicrobial Compositions

It is fundamental to achieving the benefits of the present invention that the undissociated acid from the organic acids disclosed hereinbefore remain on the skin in the protonated form. Thus, the pH of the antimicrobial compositions of the present invention must be adjusted to a sufficiently low level in order to either form or deposit substantially undissociated acids onto the substrate for which treatment is desired. By "substantially undissociated," it is meant that, upon application of the present compositions onto a target substrate, such as mammalian skin, about 30%, preferably 50%, more preferably 70%, of the organic acids incorporated in said compositions remain undissociated following the elapse of about 30 minutes from application. The pH of the present compositions should be adjusted and preferably buffered to achieve the desired range. In another aspect of the present invention, the antimicrobial compositions disclosed herein are characterized by a pH of from about 2.0 to about 4.5, preferably from about 2.5 to about 4.0. Indeed, the pH of the antimicrobial compositions of the present invention will depend upon the precise ingredients incorporated into the subject compositions. Nevertheless, the pH of the present compositions is generally, and preferably, above about 2.0, as compositions characterized by a pH below 2.0 are typically required to be identified as toxic or hazardous materials.

Mildness of Antimicrobial Compositions

Topically applied products, including rinse-off cleansers and leave-on sanitizers, have conventionally possessed the tendency to irritate or dry mammalian skin. The compositions of the present invention, however, provide immediate and residual kill of bacteria and viruses, while possessing the fundamental characteristic of mildness. By "mildness" it is meant the degree to which a composition prevents dryness or irritation to skin. Factors that influence the mildness of a topically applied antimicrobial product include, but are not limited to, duration of exposure to the product, the frequency of use of the product and the degree to which the skin is occluded following exposure to the product.

Irritation is observed by several methods, including but not limited to, visual and instrumental assessment of the erythema for redness and of the skin for edema following application of an antimicrobial product. Irritation may be measured by determining the transepidermal water loss (TEWL) of skin before and after exposure to an antimicrobial product, using, for example, a TEWL meter. Indeed, products that cause irritation may eventually compromise the natural barrier function of mammalian skin - resulting in increased water loss through the epidermis. Dryness is observed by several methods including, but not limited to, visual and instrumental assessment of the level and severity of dry skin flakes following exposure to an antimicrobial product. Dryness may be measured by instruments that examine the water content of the skin. One such instrument, a corneometer, measures the water content of skin via capacitance.

The present invention, despite its enormous cleaning and antimicrobial characteristics, is adapted to ensure increased mildness to mammalian skin upon application, particularly when compared to conventional cleansers such as bar or liquid soap and leave-on sanitizers. Indeed, the efficacy and mildness of the compositions of the present invention has been examined and illustrated under a variety of use conditions and methods. Namely, during a 10-day clinical forearm study, subjects applying the compositions of the present invention experienced significantly less skin irritation and dryness than subjects engaging in the same number of washes per day with soap and water and subjects applying conventional alcohol-based hand sanitizers. The results of the aforementioned study were measured using both visual and instrumental methods. The 10-day clinical forearm study is intended to mirror the hand washing and/or sanitizer use frequency typically recommended for proper hygiene. In another study, the leave-on application of the present compositions was applied 4 times daily, in addition to normal hand washing, and resulted in no measurable skin irritation or dryness.

Products Incorporating Antimicrobial Compositions

The present invention further relates to products that comprise the antimicrobial compositions of the present invention, as well as combinations of such products. Indeed, the combined and systematic use of products containing the antimicrobial compositions of the present invention serves to eradicate viruses (*e.g.* rhinovirus, rotavirus, respiratory syricytial virus (RSV), coronavirus) and bacteria (*e.g.* Gram-positive and Gram-negative) for a longer period of time and prevent their spread.

Personal Care Products

Thus, in accordance with a first aspect of the present invention, personal care products comprising the antimicrobial compositions of the present invention are disclosed. Suitable personal care products comprising the antimicrobial composition of the present invention, include, but are not limited to: hand soaps, hand sanitizers, body washes, mouth washes, toothpastes, shower gels, shampoos, body lotions, deodorants, nasal sprays, foot care, vaginal care and/or wash, pet care and combinations thereof. In yet another aspect of the present invention, the personal care products disclosed herein take the form of a wipe product, particularly suitable for wiping or drying the face or hands. In such instance, the antimicrobial compositions of the present invention are preferably embedded or impregnated into said wipe product. In yet still another aspect of the present invention, the personal care product disclosed herein takes the form of a tissue or towel, also suitable for wiping or drying the face or hands. In another aspect of the present invention, the personal care product takes the form of a feminine napkin and/or a diaper. In another aspect of the present invention, the personal care product takes the form of a first aid antiseptic for irritated, injured, or acne-affected skin and/or for pre or post surgical use.

Household Care Products

In another aspect of the present invention, the antimicrobial compositions of the present invention are incorporated into one or more household care products. Indeed, suitable household care products for purposes of the present invention include, but are not limited to: hard surface cleaners, deodorizers, fabric care compositions, fabric cleaning compositions, manual dish detergents, automatic dish detergents, floor care compositions, kitchen cleaners or disinfectants, bathroom cleaners or disinfectants and combinations thereof. In another aspect of the present invention, the household care product takes the form of a wipe or towel, suitable for household cleaning and/or care. In yet another aspect of the present invention, the household care products

disclosed herein comprise certain adjunct ingredients. Said adjuncts include, but certainly are not limited to: detersive enzymes, builders, bleaching agents, bleach activators, transitional metal bleach catalysts, oxygen transfer agents and precursors, soil release agents, clay soil removal and/or anti-redeposition agents, polymeric dispersing agents, brightener, polymeric dye transfer inhibiting agents, chelating agents, anti-foam agents, alkoxylated polycarboxylates, fabric softeners, perfumes, carriers, hydrotropes, processing aids, dyes or pigments, solvents for liquid formulations, solid fillers, detersive surfactants and combinations thereof.

Skin Care Products

In another preferred aspect of the present invention, the antimicrobial compositions of the present invention are incorporated into a skin care product. In one aspect of the present invention, the skin care product incorporates a dermatologically acceptable carrier to facilitate safe transfer of the antimicrobial composition of the present invention to the desired area of the skin. In another aspect of the present invention, the skin care product of the present invention comprises certain adjunct ingredients. Said adjuncts include, but certainly are not limited to: antimicrobial and antifungal actives, surfactants, desquamation actives, anti-acne actives, anti-wrinkle actives, anti-atrophy actives, anti-oxidants, radical scavengers, chelators, flavonoids, anti-inflammatory agents, anti-cellulite agents, topical anesthetics, tanning actives, sunscreen actives, conditioning agents, thickening agents, detackifying agents, odor control agents, skin sensates, antiperspirants and mixtures thereof. Indeed, a complete description and examples of each of the aforementioned adjunct ingredients is set forth in US Patent Number 6,294,186, assigned to The Procter and Gamble Company, Cincinnati, Ohio and incorporated herein by reference.

Articles of Manufacture & Kits

Moreover, articles of manufacture comprising the antimicrobial compositions of the present invention and/or one or more of the aforementioned products, are intended for personal care, skin care and household care applications. The article of manufacture of the present invention encompasses one or more products as described hereinbefore that may be packaged in a container or dispenser with a set of instructions for the consumer. The article of manufacture of the present invention typically comprises (a) container or dispenser, (b) product and (c) set of instructions to apply said product to an appropriate substrate to achieve immediate and residual antimicrobial activity. Containers and/or dispensers suitable for the article of manufacture of the present invention include, but are not limited to: PET bottles and tubs, flow-wrap pouches, foaming dispensers, spray dispensers and combinations thereof. To reiterate, the article of

manufacture of the present invention further comprises a set of instructions in association with the container. By "in association with," it is meant that the instructions are either directly printed on the container or dispenser itself or presented in a different fashion including, but not limited to: a brochure, print advertisement, electronic advertisement and/or verbal communication, so as to communicate the set of the instructions to a consumer of the article of manufacture.

The set of instructions typically comprise the instructions relating to the use of the product to apply the antimicrobial composition of the present invention onto a suitable substrate for which treatment is sought. The set of instructions may further comprise the instruction to allow the antimicrobial composition of the present invention to remain on the treated substrate, without rinsing or otherwise removing the antimicrobial composition from the treated substrate. Nevertheless, the precise instructions included with the article of manufacture of the present invention will depend on the precise ingredients of the subject antimicrobial composition and the product for which the inclusion of instructions is desired and the substrate onto which application of the product is intended. In another aspect of the present invention, the instructions included in the present articles of manufacture coincide with the methods set forth in the "Methods of Use" section of the present disclosure.

Methods of Use

The antimicrobial compositions and products of the present invention are suitable for a variety of uses. Indeed, suitable uses of the present compositions include, but certainly are not limited to, the eradication of viruses and/or bacteria; the provision of residual anti-viral efficacy; the provision of residual antibacterial efficacy; the prevention and/or treatment of a common cold or associated respiratory disease in a mammal; the prevention and/or treatment of a diarrhea disease in a mammal; the prevention and/or treatment of bacteria-related diseases in mammals resulting from contact with a bacteria-infected surface; the sanitization of hard surfaces; the improvement of the overall health of a mammal; the reduction of absenteeism; the prevention and/or treatment of dandruff and acne; and combinations thereof. It should be noted that, in the case of preventing or treating a common cold or respiratory disease, treatment with the compositions and products disclosed herein is effective when the cold or respiratory disease is caused by rhinovirus, coronavirus or RSV. It should be noted that, in the case of diarrhea, treatment with the present compositions and/or products is effective when the diarrhea is caused by rotavirus or bacteria.

Indeed, in one aspect of the present invention, a method of killing bacteria is provided. Said method comprises the steps of topically applying the composition and/or product of the

present invention to an area in need of treatment and, optionally, removing said composition and/or product following application. In another aspect of the present invention, a method of inactivating viruses is disclosed. Said method, too, comprises the steps of topically applying the composition and/or product of the present invention to an area in need of treatment and, optionally, removing said composition and/or product following application. The method of inactivating viruses is useful in treating viruses selected from the group consisting of: rotavirus, rhinovirus and combinations thereof.

Indeed, in another aspect of the present invention, a method of providing residual antibacterial and antiviral efficacy is provided. Said method preferably comprises the steps of topically applying the composition and/or product of the present invention to an area in need of treatment and, optionally, removing said composition following application. In yet another aspect of the present invention, a method of preventing and/or treating a respiratory disease or diarrhea in a mammal where the sickness is caused by a rhinovirus, coronavirus, RSV or rotavirus, respectively, is envisioned. Said method comprises the steps of topically applying the composition and/or products of the present invention to an area of the mammal in need of treatment and, optionally, removing said composition and/or product following application. Moreover, the present invention seeks to encompass a method of preventing and/or treating bacteria-related diseases in a mammal that result from said mammal's contact with a bacteria-infected substrate. Said method comprises the steps of topically applying the composition and/or product of the present invention to an area of the mammal that is infected with said bacteria and, optionally, removing said composition and/or product following application.

To reiterate, each of the methods of the present invention comprise the step of topically applying a composition or product comprising same to an area or surface in need of treatment. Examples of areas and/or surfaces in need of treatment, against which the compositions of the present invention are effective, include, but are not limited to: one or more hands, a nose, a nasal canal or passage, an article of clothing, a hard surface, irritated, acne-affected, or injured skin, pre or post surgical areas and combinations thereof.

The exact amount of antimicrobial composition and/or nature of a product will depend upon the needs and abilities of the formulator and practitioner of the present methods. Nevertheless, when the antimicrobial compositions or products of the present invention are topically applied to keratinous tissue, *e.g.* adult hands, they are applied in doses of from about 0.1 mL to about 5 mL per use, more preferably 0.5 mL to about 4 mL, most preferably from about 1 mL to about 3 mL. Moreover, the compositions and products of the present invention are topically applied to surfaces in need of treatment from about 2 to about 6 times daily. Once

applied, the compositions are rubbed on the treated surfaces for a period of time to ensure coverage, typically at least 5 seconds, preferably at least 10 seconds, more preferably at least 20 seconds and most preferably at least 30 seconds.

PREPARATIVE EXAMPLES

The antimicrobial compositions and products of the present invention were prepared in accordance with the present disclosure. Table 1 and 2, set forth as follows, summarizes the preparation of sixteen antimicrobial compositions in accordance with the present invention. Example 12 and 16 relate to the preparation of a concentrated version of the antimicrobial compositions of the present invention. The product solution of Examples 1 to 12 in Table 1 changed opacity from clear to hazy over time, due to the slow hydrolysis of hydrogenated castor oil. However, the antimicrobial efficacy of the solutions included therein remained unaffected. Contrarily, Examples 13 to 16 in Table 2 remained stable as clear aqueous solutions with consistent antimicrobial performance after prolonged storage under stressed conditions (*e.g.* one month at 45 degree C). Moreover, Tables 3 to 6 summarize the efficacy of a few examples, the preparation of which is summarized in Tables 1 and 2. The following disclosure further includes a discussion of the testing methods and results of the compositions disclosed herein, as well as methods for preparing one or more products in accordance with the present invention.

TABLE 1 – COMPOSITIONAL EXAMPLES

Component	EX 1	EX 2	EX 3	EX 4	EX 5	EX 6	EX 7	EX 8	EX 9	EX 10	EX 11	EX 12 (Conc)
Sodium Octyl Glyceryl Sulfonate	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	15
Sodium Salt Pyrrolidone Carboxylate	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5	
Gluconic Acid									1.5	1.5		15
Hydrogenated Castor Oil	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	1.0
Perfume	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.05-0.1	0.5-1.0
Citric Acid anhydrous	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		0.5		5
Malic Acid											1.5	
Methyl Cellulose		1.0										1.0
3[(2-Ethyhexyl) oxy] 1,2 Propanediol			0.5									
Benzalkonium Chloride				0.1								
Propylene Glycol					3							
2-Propanol						8						
Aloe Vera							0.1					
Menthol								0.1				
PH adjusted by 1N NaOH	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	*3.0*

TABLE 2: COMPOSITIONS EXAMPLES

Component	EX 13	EX 14	EX 15	EX 16 (Conc)
Sodium Octyl Glyceryl Sulfonate	0.5	0.5	0.5	10
Gluconic Acid	2.0	2.0	2.0	20
Isoceteth-20		0.35	0.35	2-5
Propylene Glycol		0.1-0.3	0.25	2-5
Perfume		0.075-0.125	0.15	1-2
Methyl Cellulose			1.0	
Polyacrylic Acid (MW 3000-6000)			0.25	
Aloe Vera		0.1	0.2	2
Menthol		0.05	0.15	
Ethanol			10	
PH adjusted by 1N NaOH	3.0	3.0	3.0	3.0

TABLE 3 - EFFICACY OF COMPOSITIONS

Liquid Composition	Challenge Organism	Log reduction Time Kill (1 min):

		Suspension Test
EX 7	E. coli ATCC 11229	>4
EX 7	Corynebacterium striatum ATCC 6940	>4
EX 7	Corynebacterium mucifaciens axillary isolate 29	>3
EX 7	Staphylococcus epidermidis ATCC 35984	3
EX 7	Staphylococcus epidermidis axillary isolate 9	>4

TABLE 4- EFFICACY OF COMPOSITIONS

Liquid Composition	E. coli Log reduction Time Kill (1 min): solution & wipe	E. coli Log Reduction Immediate: Vitro skin	E. coli Log Reduction Residual: Vitro skin	Rotavirus Log Reduction Immediate: Vitro skin	Rotavirus Log Reduction Residual: Bio skin
EX 1	5	4	4	3	
EX 3	5	5	5	3	3
EX 4		3	3		
EX 7		4	4		
EX 8		4	5		
EX 9		4	4		
EX 10		3	4		
EX 11	5	3	4	2	

TABLE 5 - EFFICACY OF COMPOSITIONS

CHALLENGE ORGANISM	EX13	EX 14
E. coli 11229: Log Reduction Immediate; Bio skin	5	5
Log Reduction Residual; Bio skin	5	5
Rotavirus Strain WA from University of Ottawa, Ontrio, Canada:	4	4

Log Reduction Immediate; Bio skin		
Log Reduction Residual; Bio skin	3	5
Corona Virus ATCC 229 E:		
Log Reduction Immediate; Bio skin		4
Log Reduction Residual; Bio skin		4
Rhinovirus ATCC 16:		
Log Reduction Immediate; Bio skin	4	4
Log Reduction Residual; Bio skin		3
RSV ATCC VR-26:		
Log Reduction Immediate; Bio skin	4	

TABLE 6 – EFFICACY OF WIPE PRODUCTS

Wipe Product	E. coli Log reduction Time Kill (5 min): wipe substrate
EX 1	3
EX 9	4

Compositional Testing

Antibacterial Efficacy Assay in vitro skin #1013 (JMS) /bio skin black #10

Method: Assay in vitro skin/ bio skin

Immediate Efficacy:

10 uL of test bacteria suspension was spread on mammalian skin and allowed to air dry for one minute, then 20 uL of the active solution was spread evenly over the treated skin and the preparation was allowed to rest uncovered for five minutes. The skin substrate was placed into a test tube containing 10 mL of extraction solution (Phosphate buffer with Triton X-100, Lecithin and Tween) and vortex for 30 seconds. A 50 uL aliquot was dispensed (via Spiral Biotech

Autoplater) onto Trypticase Soy Agar + 1.5% Tween 80 plates and viability was determined after 18 hours of incubation at 37°C (CUF/ml)

Residual Efficacy:

20 uL of the active solution was spread evenly over mammalian skin and allowed to dry for 15min. 10 uL of test bacteria suspension was spread evenly over the treated skin and the preparation was allowed to rest covered for five minutes. . The skin substrate was placed into a test tube containing 10 mL of extraction solution (Phosphate buffer with Triton X-100, Lecithin and Tween) and vortex for 30 seconds. A 50 uL aliquot was dispensed via Spiral Biotech Autoplater onto Trypticase Soy Agar + 1.5% Tween 80 plates and viability was determined after 18 hours of incubation at 37 °C (CUF/ml)

Method: Solution Assay - Bacterial Time Kill:

A 50 uL of test bacteria suspension (TSB) culture with a density of 1.0E+09 CFUs/ml was mixed with 5 ml of the active solution. After one minute time, the inoculated solution was mixed with DE neutralizing broth (ratio 1:10). A 50-uL aliquot was dispensed via Spiral Biotech Autoplater onto a Trypticase Soy Agar plate. Viability was determined after 18 hours of incubation at 37°C (CUF/ml)

Method: Viral Efficay Assay in vitro skin #1013 (IMS) /bio skin black #10

Immediate Efficacy:

10 uL of test virus suspension was spread on the skin substrate and allowed to air dry at room temperature then 25 uL of the active solution was spread evenly over the treated skin and the preparation was allowed to rest for five minutes. Following the exposure period, a sterile 1.5 ml cryovial containing 1.0 ml of elution mediourn was inverted over the sink substrate surface and extraction was performed. The solution was mixed and serial 10 fold dilution was performed. The dilutions were assayed for the presence of virus in a host system. The virus titer of the stock was determined by the median cell culture infective dose (TCID 50). Cytotoxicity to the host system (active solution) at tested concentrations was also determined. The virus-product mixture was assayed in numerous units of the host system. Median values of log 10 virus inactivation were calculated.

Residual Efficacy:

25 uL of the active solution was spread evenly over the skin and allowed to dry for 15 min. 10 ul of the test virus suspension was spread evenly over the treated skin and the preparation remained in contact for five minutes. Following the exposure period, a sterile 1.5 ml cryovial containing 1.0 ml of elution mediom was inverted over the sink substrate surface and extraction was performed. The solution was mixed and serial 10 fold dilution was performed. The dilutions were assayed for the presence of virus in a host system. The virus titer of the stock was determined by the median cell culture infective dose (TCID 50). Cytotoxicity to the host system (active solution) at tested concentrations was also determined. The virus-product mixture was assayed in numerous units of the host system. Median values of log 10 virus inactivation were calculated.

Method: Microbial Susceptibly Test (MST) for Wet Wipes - Time Kill:

A test wipe was inoculated with 1.0 ml of virus suspension to cover one quarter of the folded wipe. 5 minutes after inoculation the treated wipe was placed into a sterile bag containing 100 ml of DE neutralizer medium, the bag was sealed and placed in the Stomacher for 2 minutes. After blending, a 50 uL aliquot was dispensed (via Spiral Biotech Autoplater) onto Trypticase Soy Agar + 1.5% Tween 80 plates and viability was determined after 18 hours of incubation at 37°C (CUF/ml)

Liquid Composition Preparation for use in Products

Blend the liquefied Isoceteth 20 (Example 14-16), Hydrogenated Castor Oil (Example 1-12), Perfume, Menthol (Example 8, 14 and 15), Propylene Glycol (Example 5, 14, 15 and 16) and (2-Ethyhexyl) Glycerol ether (Example 3). Emulsify the pre-mixed blend to a pre-dissolved Sodium Glyceryl sulfonate solution. Add and dissolve Sodium Pyrrolidone Carboxylate (Example 1-9 and 11), Citric Acid (Example 1-10, 10 and 12), Gluconic Acid (Examples 9, 10, 12-16) and Malic Acid (Example 11). Add to mixture, Isopropanol (Example 6), Ethanol (Example 15), Aloe Vera (Example 7 and 14-16). Adjust pH to 3.0 by 1N Sodium Hydroxide solution or 1N Phosphoric Acid. Slowly add Benzalkonium chloride solution (Example 4). Add Methyl Cellulose (5% aqueous solution) during mixing (Example 2 and 15). Adjust pH to 3.0 by 1N Sodium Hydroxide solution or 1N Phosphoric Acid. Add remaining water to make a target product weight. Check final pH.

Products Preparation

Example 13: Antimicrobial Hand Sanitizer

To deliver the benefits of the present invention in a hand sanitizer form, the liquid composition produced in accordance with the previous section may be packaged in a typical PET bottle with a flip-top cap. Liquid is dispensed to the hands in an amount to ensure complete wetting. Employing this method delivers immediate microbial kill and, upon drying, provides prolonged, residual activity.

Example 14: Antimicrobial Wipe

The lotion produced in accordance with the previous section may be used to produce a wet wipe product for topical cleaning and/or sanitizing of skin and/or hard surfaces. Such a product is made by saturating a paper or cloth substrate with the liquid composition prepared in accordance with the previous section. The level of saturation depends upon the substrate in which incorporation of the antimicrobial composition is desired. A 5" x 8" hand wipe towelette made from 40-60 grams per square meter spun-lace non-woven material may be saturated with about 1-3 grams of liquid composition. The liquid may be applied to the substrate via spraying and/or soaking prior to final packaging. The wipe may be wrapped in single use pouches made from foil or plastic or packed in groups of 10, 40, or more in multiple use tubs.

To deliver the benefits of the present invention in this form, the wipe is removed from its package and is rubbed onto the target surface, in a manner that ensures complete wetting of the surface. The wetting practice removes visible dirt and eradicates bacteria and viruses. Upon drying, the surface experiences residual antimicrobial activity for several hours.

Example 15: Antimicrobial Drying Towel

The lotion produced in accordance with the previous section may be used to produce a dry towel product for topical cleaning and/or sanitizing of skin or hard surfaces. Such a product is made by saturating a paper or cloth substrate with the liquid prepared in accordance with the preceding section. The substrate is then dried to remove all water. The level of saturation depends upon the substrate in which incorporation of the antimicrobial composition is desired. A 5" x 8" towel made from 40-60 grams per square meter spun-lace non-woven material may be saturated with about 1-3 grams of liquid. The liquid may be applied to the substrate via spraying and/or soaking prior to final packaging. The liquid may also be applied in concentrate form using

printing techniques employed in the color design of commercial, paper towels. The towel may then be rolled or inserted into boxes.

To deliver the benefits of the present invention in this form, the towel is applied to any wet skin or hard surface to dry it. The water activates the antimicrobial properties of the composition within the towel, which is then imparted onto the surface. Employing this method, the towel dries the target surface, removes visible dirt, delivers anitmicrobial kill and provides prolonged, residual activity.

Example 16: Anti-inflammatory Efficacy of RID Compositions

Indeed, the antimicrobial compositions, methods and products of the present invention have demonstrated surprising anti-inflammatory benefits in the topical treatment of inflammation or dermatitis. *In vitro* studies of the present invention and its key components have been conducted to assess the efficacy of the claimed compositions in inhibiting the cycloxygenase (COX) 1 and 2 enzymes. Said enzymes are adapted to convert arachidonic acid in cell membranes to prostaglandin, a messenger agent that conveys a signal to the cells to increase and enhance their inflammatory response. The results of the aforementioned *in vitro* study demonstrate that the present invention can significantly reduce the activity of both COX 1 and 2 enzymes. This is particularly important when considered in light of the fact that the key components of the present invention, namely, the short chain anionic surfactant with a large head group or branched structure, the organic acid, and the optional calcium ion-scavenging agent, demonstrate only limited efficacy upon employment individually. The results of this *in vitro* study have been documented in the below-listed chart.

Treatment Sample (at pH 3.0)	% of Initial Enzyme Activity	
	COX-1	COX-2
A. 0.5% Octyl Glyceryl Sulfonate	55	95
B. 0.5% Pyroglutamic Acid	100	92
C. 1.5% Citric Acid	94	100
D. A + B + C	43	53

All documents cite are, in relevant part, incorporated herein by reference; the citation of any document is not to be construed as an admission that it is prior art with respect to the present invention.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

WHAT IS CLAIMED IS:

1. An antimicrobial composition characterized by comprising an antimicrobial active and an anionic surfactant mixture characferized by comprising a characteristic selected from the group consisting of:
   a. a linear alkyl chain having a chain length of from C_4 to C_{12} and a total head group size of at least 4 Angstroms;
   b. a branched alkyl chain having a chain length of from C_4 to C_{12};
   c. an unsaturated alky chain having a chain length of from C_4 to C_{12}; and
   d. combinations thereof.

2. An antimicrobial composition characterized by comprising:
   a. from 0.2% to 70% of an organic acid; and
   b. from 0.1% to 40% of an anionic surfactant mixture characterized by comprising a characteristic selected from the group consisting of;
      i. a linear alkyl chain having a chain length of from C_4 to C_{12} and a total hydrophilic head group size of at least 4 Angstroms;
      ii. an unsaturated alkyl chain having a chain length of from C_4 to C_{12};
      iii. a branched alkyl chain having a chain length of from C_4 to C_{12}; and
      iv. combinations thereof

   wherein said composition is characterized by comprising a pH of from 2.0 to 4.5.

3. The composition according to any one of the preceding claims, further characterized by comprising a calcium ion scavenger.

4. The composition according to any one of the preceding claims, further characterized by comprising an anti-foam agent.

5. The composition according to any one of the preceding claims, wherein said anionic surfactant is characterized by being selected from the group consisting of: alkyl glyceryl sulfonate, branched alkyl glyceryl sulfonate, alpha sulfo fatty acid, alkyl olefin sulfonate, branched alkyl sulfonate, branched alkyl benzene sulfonate and secondary alkyl sulfate, mono ester of alkyl sulfosuccinic acid, alkyl isethionate, alkyl amidosulfonate, alkyl phosponate, alkyl phosphate and combinations thereof.

6. The composition according to any one of the preceding claims, further wherein said anionic surfactant is characterized by being substituted with a substituent selected from the group consisting of: sulfonate, sulfate, phosphonate and combinations thereof.

7. The composition according to any one of the preceding claims wherein said organic acid is characterized by being selected from the group consisting of: pyroglutamic acid, adipic acid, gluconic acid, gluconolactone acid, glutamic acid, glutaric acid, glycolic acid, tartaric acid, ascorbic acid, benzoic acid, salicylic acid, citric acid, malic acid, succinic acid, lactic acid carboxymethylcellulose and combinations thereof.

8. The composition according to any one of the preceding claims wherein said organic acid is characterized by comprising a pKa of greater than 3.0.

9. The composition according to any one of the preceding claims wherein said calcium ion scavenger is characterized by being selected from the group consisting of: carboxymethylaspartic acid, citric acid, malic acid, polyacrylic acid, copolymer of acrylic acid and maleic acid, oxydisuccinic acid, nitrilotriacetic acid, iminodisuccinic acid, succinic acid, tartrate disuccinic acid, tartrate monosuccinic acid, ethylenediaminetetraacetic acid, pyrophosphoric acid and combinations thereof.

10. The composition according to any one of the preceding claims wherein said calcium ion scavenger is characterized by comprising a pKa of lower than 3.0.

11. The composition according to any one of the preceding claims wherein said calcium ion scavenger is characterized by comprising a calcium ion binding constant log P of greater than 3.0 at a pH of 3.

12. The composition according to any one of the preceding claims wherein said anti-foam agent is characterized by being selected from the group consisting of silicone emulsion, mineral oil emulsion, hydrocarbon oil emulsion, polyalkylene emulsion and combinations thereof.

13. The composition according to any one of the preceding claims wherein said anti-foam agent is characterized by being present in an amount of at least 1 ppm by weight of total composition.

14. The composition according to any one of the preceding claims wherein said anti-foam agent is characterized by comprising the structure of dimethyl silicone or a hydrocarbon moiety in oil in water emulsion.

15. The composition according to any one of the preceding claims, characterized by comprising a nonionic agent.

16. The composition according to any one of the preceding claims, wherein said nonionic agent is characterized by comprising a substituent selected from the group consisting of: alcohol, polyol, chloro phenol and combinations thereof.

17. The composition according to any one of the preceding claims, wherein said nonionic agent is branched or linear.

18. The composition according to any one of the preceding claims, wherein said nonionic agent is characterized by comprising a chain length of from C_4 to C_{12}.

19. The composition according to any one of the preceding claims, wherein said nonionic agent is characterized by being selected from the group consisting of: 1-(2-ethylhexyl) glycerol ether, octyl glycerol ether, 2-(2-ethylhexylxoxy) propanol, octyloxy-propanol, 1-(2-ethylhexyloxy) ethanol, octyloxy ethanol, 1,2-hexylenediol, 1,2-cyclohexanedimethanol, isopropyl glycerol ether, 4-chloro-3-xylenol and combinations thereof.

20. The composition according to any one of the preceding claims, wherein said nonionic agent is characterized by being present in an amount of from 0.1% to 10% by weight of total composition.

21. The composition according to any one of the preceding claims, characterized by comprising an alkyl poly ether-type emulsifier.

22. An antimicrobial product characterized by comprising the antimicrobial composition according to any one of the preceding claims.

23. The antimicrobial product according to according to any one of the preceding claims, wherein said product is a personal care product.

24. The personal care product according to any one of the preceding claims, wherein said personal care product is characterized by being selected from the group consisting of: hand soaps, hand sanitizers, body washes, shower gels, shampoos, body lotions, feminine care products, foot care products, deodorants, pet care products and combinations thereof.

25. The antimicrobial product according to according to any one of the preceding claims, wherein said product is characterized by being a household care product.

26. The household care product according to any one of the preceding claims, wherein said product is characterized by being selected from the group consisting of hard surface cleaners, deodorizers, fabric care compositions, fabric cleaning compositions, manual dish detergents, automatic dish detergents, floor waxes, kitchen cleaners, bathroom cleaners and combinations thereof.

27. The antimicrobial product according to according to any one of the preceding claims, wherein said product is characterized by being selected from the group consisting of: a wipe product suitable for personal care use and household cleaning; a toilet tissue; a towel for hand drying, household drying and household cleaning; a facial tissue; a skin care composition; a first aid or surgical antiseptic; a feminine napkin; a diaper and combinations thereof;
prefereably wherein said skin care composition is further characterized by comprising a dermatologically acceptable carrier.

28. A method of killing bacteria, said method characterized by comprising the step of topically applying the composition according to any one of the preceding claims to an area in need of treatment.

29. A method of inactivating viruses, said method characterized by comprising the step of topically applying the composition according to any one of the preceding claims to an area in need of treatment.

30. The method of according to any one of the preceding claims, wherein said viruses are characterized by being selected from the group consisting of: rotavirus; rhinovirus; respiratory syncytial virus; and combinations thereof.

31. A method of providing residual antibacterial efficacy, said method comprising the step of topically applying the composition according to any one of the preceding claims to an area in need of treatment.

32. A method of preventing and/or treating a common cold, respiratory disease and diarrhea in a mammal where said diseases are caused by rhinovirus or rotavirus, said method characterized by comprising the step of topically applying the composition according to any one of the preceding claims to an area of the mammal in need of treatment.

33. A method of preventing and/or treating bacteria-related diseases in a mammal that result from said mammal's contact with a bacteria-infected substrate, said method characterized by comprising the step of topically applying the composition according to any one of the preceding claims to an area of the mammal which is infected with said bacteria.

34. A method of reducing inflammation, said method characterized by comprising the step of topically applying the composition according to any one of the preceding claims to an area in need of treatment.

35. The method according to according to any one of the preceding claims, wherein said inflammation is characterized by being caused by a source selected from the group consisting of: plants, diaper rash, insect bites, allergic inflammatory reactions and combinations thereof.

36. A method of preventing inflammation, said method characterized by comprising the step of topically applying the composition according to any one of the preceding claims to an area for which the prevention of inflammation is desired.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/19718

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01N41/04 A01N25/30 A01N61/00 A61K7/48
//(A01N41/04,61:00,37:42,37:36),(A01N61/00,61:00,37:42,37:36)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01N A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00/61106 A (PROCTER & GAMBLE) 19 October 2000 (2000-10-19) page 1, paragraph 1 page 3, paragraph 6 - page 4, paragraph 3 page 7, paragraph 2 - paragraph [0004] page 11, paragraph 4 - page 16, paragraph 5 page 17, paragraph 7 - page 19, paragraph 4 page 23, paragraph 6	1-3, 5-11, 15-18, 21-24, 27-29, 31,33
Y		1-36

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 November 2003	17 MAR 2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lamers, W

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/19718

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98/37866 A (UNILEVER PLC ;UNILEVER NV (NL)) 3 September 1998 (1998-09-03) page 1, line 12 - line 19 page 5, line 25 - line 33 page 6, line 8 - line 26 page 7, line 1 - line 5 page 8, line 1 - page 10, line 6 page 11, line 1 - line 26 page 13, line 3 - line 31 page 15, line 23 - line 24	1-3, 5-11, 15-18, 22-24, 28,31,33
Y	-----	1-36
X	WO 91/09924 A (PROCTER & GAMBLE) 11 July 1991 (1991-07-11) page 3, line 2 - line 13 page 7, line 35 - line 36 page 8, line 22 - page 9, line 32 page 14 - page 15; tables 1,2 page 23; table 8	1,3,5,6, 9-11, 15-18, 22-28, 31,33
Y	-----	1-36
X	US 5 006 529 A (RESCH CAROL M) 9 April 1991 (1991-04-09) column 1, line 11 - line 14 column 1, line 33 - line 43 column 1, line 54 - line 68 column 2, line 47 - line 63 column 5; table VI	1,5,6, 22-24, 27,28, 31,33
X	-----	1-11,13, 15-18, 20-29, 31,33
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/19718

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98/55080 A (PROCTER & GAMBLE) 10 December 1998 (1998-12-10) page 3, paragraph 2 - paragraph [0006] page 4, paragraph 4 page 8, paragraph 4 - page 12, paragraph 2 page 13, paragraph 3 - page 14, paragraph 4 page 14, paragraph 6 - page 19, paragraph 1 -----	1-3, 5-11, 15-18, 21-24, 27,28, 31,33
X	US 5 523 324 A (SUBRAMANYAM RAVI ET AL) 4 June 1996 (1996-06-04) column 1, line 66 - column 2, line 45 column 3, line 56 - line 59 -----	1,5,6, 22-24, 27,28, 31,33
X	US 6 110 445 A (GAFFAR ABDUL ET AL) 29 August 2000 (2000-08-29) column 1, line 16 - line 19 column 1, line 50 - column 3, line 11 -----	1,5, 15-17, 22,23, 28,31,33
P,X	WO 02/080668 A (KIMBERLY CLARK CO) 17 October 2002 (2002-10-17) page 1, line 3 - line 13 page 2, line 28 - page 5, line 3 page 7, line 5 - page 11, line 18 page 14, line 14 - page 16, line 26 -----	2,3,5, 7-11, 22-24, 27-29, 31,33
A	S.S.BLOCK: "DISINFECTION, STERILIZATION, AND PRESERVATION (fourt edition)" 1991, LEA & FEBIGER , PHILADELPHIA, US , XP002260681 CHAPTER 14: G.R.Dychdala et al.:"SURFACE-ACTIVE AGENTS: ACID-ANIONIC COMPOUNDS"; pages 256 - 262 the whole document -----	1-36

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/19718

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

Although claims 32 - 43 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compositions.

2. [X] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. [X] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-36 (partially)

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-36 (partially)

An antimicrobial composition characterized by comprising an antimicrobial active and an anionic surfactant mixture characterized by comprising a characteristic of a linear alkyl chain having a chain length of from C4 to C12 and a total head group size of at least 4 Angstroms and/or an antimicrobial composition characterized by comprising a. from 0,2% to 70% of an organic acid and b. from 0,1% to 40% of an anionic surfactant mixture characterized by comprising a characteristic of a linear alkyl chain having a chain length of from C4 to C12 and a total hydrophilic head group size of at least 4 Angstroms;
compositions, products and methods as described in claims 3 - 36.

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2. claims: 1-36 (partially)

An antimicrobial composition characterized by comprising an antimicrobial active and an anionic surfactant mixture characterized by comprising a characteristic of a branched alkyl chain having a chain length of from C4 to C12 and/or an antimicrobial composition characterized by comprising a. from 0,2% to 70% of an organic acid and b. from 0,1% to 40% of an anionic surfactant mixture characterized by comprising a characteristic of a branched alkyl chain having a chain length of from C4 to C12;
compositions, products and methods as described in claims 3 - 36.

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3. claims: 1-36 (partially)

An antimicrobial composition characterized by comprising an antimicrobial active and an anionic surfactant mixture characterized by comprising a characteristic of an unsaturated alkyl chain having a chain length of from C4 to C12 and/or an antimicrobial composition characterized by comprising a. from 0,2% to 70% of an organic acid and b. from 0,1% to 40% of an anionic surfactant mixture characterized by comprising a characteristic of an unsaturated alkyl chain having a chain length of from C4 to C12;
compositions, products and methods as described in claims 3 - 36.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 03/19718

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Information on patent family members

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